Chuanhao Sun

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EDUCATION

University of Edinburgh	Edinburgh, U.K.
PhD in Informatics, ICSA: Institute for Computing Systems Architecture, School of Informatics	*2019.09 – 2023.12*
Beijing University of Posts and Telecommunications	Beijing, China
Research Master in Communication Engineering, School of Information Engineering	*2016.09 – 2019.06*
Beijing Jiao Tong University (GPA: 93.2/100)	Beijing, China
Bachelor in Communication Engineering, School of Electronics and Information Engineering	*2012.09 – 2016.06*

WORK EXPERIENCE

University of Edinburgh — Edinburgh, U.K.
Postdoc Researcher, Sponsored by DSIT UK — *2023.10 – Present*

- Research Associate in Applied Machine Learning and Networking.
- Focus on Innovative Application of Deep Generative Model

INTERNSHIPS

Microsoft Research, Azure for Operators (AFO) — Cambridge, U.K.
Research Intern — *2022.06 – 2022.08*

- Measure the KPI time series when playing XCloud game, and optimize the power consumption through ML based real-time traffic regularization. (Following work towards a publication)
- NR Discontinuous Reception and Client-side power measurement& traffic regulation on Open RAN testbed.

Intel Labs China (ILC) — Beijing, China
Research Intern — *2018.02 – 2019.04*

- Machine learning based algorithm with 5G link layer for potential applications.
- Contribute to a 5G simulation platform, transmitting/receiving end of DMRS for PUSCH, etc.

RECENT RESEARCH PROJECTS

Accurate, Explainable, and Efficient Anomaly Detection of Time Series. — In Progress
University of Edinburgh, Microsoft Research (AFO), and DSIT — *2023.03 – Present*

- Apply generative model (distribution learning) in network anomaly detection.
- Develop a two-stage anomaly detection algorithm - Spotlight, including an efficient CPU inference algorithm on the far edge, as well as a deep imputation-based anomaly detection algorithm on the cloud. The detection results are explained with CausalNex to figure out the root cause.
- Participated in developing a DEMO of Spotlight, running on real Open RAN testbed.
- One paper has been accepted by ACM MobiCom'24
- *Recent Work*: Towards self-anomaly detection of multivariate time series without labeled data

High Fidelity and Efficient High Dimension Function Learning in Gen AI. — In Progress
University of Edinburgh — *2023.06 – Present*

- Learning High Dimensional Functions from Low Dimensional Inputs.
- Typical Usecases: new view and speech synthesis such as NeRF, Text2Speech, and Super Resolution.
- We propose Sinusoidal Positional Encoding (SPE), improving 1D NTK regression fidelity by 2 magnitudes on learning proper high frequency functions.
- With SPE, we can control and optimize the high frequency features in speech synthesis, and implement tests on FastSpeech, where we see significant improvement on spectrum details. SPE will appear on ICML'24
- *Recent Work (1)*: Generative encoding methods to better approximate the ground truth functions.
- *Recent Work (2)*: Apply similar techniques to the real-time compression of image series.

Selected Publications

[1] **Chuanhao Sun**, Zhihang Yuan, Kai Xu, Luo Mai, Siddharth N, Shuo Chen and Mahesh Marina. 'Learning High-Frequency Functions Made Easy with Sinusoidal Positional Encoding', 41st International Conference on Machine Learning (**ICML'24**), Available at Github. 2024.

[2] **Chuanhao Sun**, Ujjwal Pawal, Molham Khoja, Xenofon Foukas, Mahesh Marina, and Bozidar Radunovic. 'SpotLight: Accurate, Explainable and Efficient Anomaly Detection for Open RAN', 30th Annual International Conference on Mobile Computing and Networking (**MobiCom'24**), on MWC. 2024.

[3] **Chuanhao Sun**, Kai Xu, Gianni Antichi, and Mahesh Marina. 'NetGSR: Towards Efficient and Reliable Network Monitoring with Generative Super Resolution'. The 20th International Conference on emerging Networking EXperiments and Technologies (**CoNEXT'24**). 2024.

[4] **Chuanhao Sun**, Ujjwal Pawal, Molham Khoja, Xenofon Foukas, Mahesh Marina, and Bozidar Radunovic. 'SpotLight – An Open RAN Anomaly Detection and Identification System', 30th Annual International Conference on Mobile Computing and Networking (**MobiCom'24 Demos**) 2024.

[5] **Chuanhao Sun**, Thanos Triantafyllou, Anthos Makris, Maja Drmač, Kai Xu, Luo Mai, Mahesh K. Marina.'PH-Dropout: Prctical Epistemic Uncertainty Quantification for View Synthesis'. **arXiv preprint**. Available at Github, 2024.

[6] **Chuanhao Sun**, Kai Xu, Mahesh Marina, and Howard Benn. 'GenDT: Mobile Network Drive Testing Made Efficient with Generative Modeling', The 18th International Conference on emerging Networking EXperiments and Technologies (**CoNEXT'22**), **Best Paper Final List**, 2022 - Rome, Italy

[7] **Chuanhao Sun**, Kai Xu, Marco Fiore, Mahesh Marina, Yue Wang, and Cezary Ziemlicki. 'AppShot: A Conditional Deep Generative Model for Synthesis of Service Level Mobile Traffic Snapshots at City Scale', IEEE Transactions on Network Service and Management (**TNSM**) 2022.

[8] **Chuanhao Sun**, Xiang Zhou, et al. " Machine Learning Enabled Mobile Video Prefetching in Mobile Edge Networks", in Proc. 16th **IEEE ICCS**, in Chengdu, China, Dec. 2018.

[9] **Chuanhao Sun**, Jizhe Zhou, et al., " Computation Offloading with Virtual Resources Management in Mobile Edge Network", in Proc. in **IEEE VTC2018-Spring**, in Porto, Portugal, Jun. 2018.

(**Full List of Publication in:** Google Scholar of Chuanhao Sun)

Relevant Courses/Training

- Oxford Machine Learning Summer School 2021. Virtual event, 20-21 July & 9-20 August, 2021.

- Mathematics of Machine Learning Summer School. Alan Turing Institute. Virtual event, 28 June - 2 July, 2021.

- IEEE ComSoc Autumn School, in CTTC, Barcelona, Spain, 5 - 8 November. 2019.

Skills

Coding: Python (PyTorch), Matlab, and Mathematica.
Technical Skills: Machine learning algorithms, especially in deep generation model on data synthesis. Signal Processing in communication system. Multi-media system, video streaming and cloud gaming (MS XCloud).

Talks

- Coseners: Next Generation Networking, Multi-Service Networks workshop. Oxford, 8-11 July, 2024. Link.

- MobiUK 2023. Alan Turing Institute. Lancaster University, 3rd July, 2023. Link.

Reference

Dr. Kai Xu, MIT-IBM Watson AI Lab, Cambridge, MA, US. **Email**: me@xuk.ai

Prof. Mahesh K. Marina (Supervisor), School of Informatics, The University of Edinburgh.
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